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24956 7590 05/07/2004
MATTINGLY, STANGER & MALUR, P.C.
1800 DIAGONAL ROAD
SUITE 370
ALEXANDRIA, VA 22314

EXAMINER

FLORES RUIZ, DELMA R

ART UNIT

PAPER NUMBER

2828

DATE MAILED: 05/07/2004

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/084,382	02/28/2002	Tatsuya Tomaru		8164

TITLE OF INVENTION: SOLID-STATE LASER COMPENSATED FOR PUMPING-LIGHT ASTIGMATISM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1330	\$300	\$1630	08/09/2004

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN **THREE MONTHS** FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

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B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check the box below and enclose the PUBLICATION FEE and 1/2 the ISSUE FEE shown above.

☐ Applicant claims SMALL ENTITY status.
See 37 CFR 1.27.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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Complete and send this form, together with applicable fee(s), to: **Mail**

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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

24956 7590 05/07/2004

**MATTINGLY, STANGER & MALUR, P.C.
1800 DIAGONAL ROAD
SUITE 370
ALEXANDRIA, VA 22314**

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

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10/084,382	02/28/2002	Tatsuya Tomaru		8164

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nonprovisional	NO	\$1330	\$300	\$1630	08/09/2004

EXAMINER	ART UNIT	CLASS-SUBCLASS
FLORES RUIZ, DELMA R	2828	372-070000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the USPTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent); ☐ individual ☐ corporation or other private group entity ☐ government

4a. The following fee(s) are enclosed:

- ☐ Issue Fee
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- ☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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(Authorized Signature)

(Date)

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This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, Alexandria, Virginia 22313-1450.

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MATTINGLY, STANGER & MALUR, P.C. 1800 DIAGONAL ROAD SUITE 370 ALEXANDRIA, VA 22314			EXAMINER FLORES RUIZ, DELMA R	
			ART UNIT 2828	PAPER NUMBER

DATE MAILED: 05/07/2004

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 141 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 141 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) system (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (703) 305-1383. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

Notic of Allowability

Applicati n N .

10/084,382

Examin r

Delma R. Flores Ruiz

Applicant(s)

TOMARU ET AL.

Art Unit

2828

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 2/6/2004.
2. ☒ The allowed claim(s) is/are 26-41.
3. ☒ The drawings filed on 8/12/2002 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
 - * Certified copies not received: _____.


Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachm nt(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____


Wilson Lee
Primary Examiner

DETAILED ACTION

Allowable Subject Matter

The following is an examiner's statement of reasons for allowance: claim 26 has been allowed over the prior art because they fail to teach a solid-state laser comprising a laser cavity where pumping light is introduced into a gain crystal via a focusing lens and a dichroic concave mirror, wherein said focusing lens is tilted with respect to the optical axis of the pumping light so that a focusing point of the pumping light in a sagittal plane and a focusing point of the pumping light in a tangential plane in the gain crystal at least approximately coincide with focusing points in the respective planes in the gain crystal in a cavity mode; wherein a focusing point of the pumping light is determined using a q-parameter defined by $1/q_i = 1/R_i - j (\lambda/\pi w_i^2)$, where w_i is a beam radius at the position i , and R_i is the radius of curvature of a wave front at a position i ; a focal length of the focusing lens having a plano-convex shape is given by $f_{1s} = n_1 R_{\text{focus}} / n_{2_ \text{focus}} \cos \Theta_{2_ \text{focus}} - n_1 \cos \Theta_{1_ \text{focus}}$ for a sagittal plane, where n_1 is a refractive index of air or vacuum, $n_{2_ \text{focus}}$ is a refractive index of the focusing lens, R_{focus} is the radius of curvature of the focusing lens, Θ is the tilting angle of the focusing lens, and $\Theta_{1_ \text{focus}}$ is the tilting angle of the focusing lens, and $\Theta_{2_ \text{focus}} = \arcsin [n_1 / n_{2_ \text{focus}} (\sin \Theta_{1_ \text{focus}})]$; a focal length of the focusing lens for a tangential plane is given by $f_{1t} = n_1 R_{\text{focus}} \cos^2 \Theta_{1_ \text{focus}} / n_{2_ \text{focus}} \cos \Theta_{2_ \text{focus}} - n_1 \cos \Theta_{1_ \text{focus}}$; focal length f_{2s} and f_{2t} of the dichroic concave mirror for a

Art Unit: 2828

transmitting light are given by $f_{2s} = n_1 R_{\text{dichroic}} / n_{2_dichroic} \cos \Theta_{2_dichroic} - n_1 \cos \Theta_{1_dichroic}$;

$f_{2t} = n_1 R_{\text{dichroic}} \cos^2 \Theta_{1_dichroic} / n_{2_dichroic} \cos \Theta_{2_dichroic} - n_1 \cos \Theta_{1_dichroic}$; an ABCD matrix

from an exit plane of the pumping light source to an arbitrary plane inside the gain crystal is given

$$\text{by } M_{17s} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} 1 & L_{56} + \frac{L_{67}}{n_{YAG}} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{2s}} & 1 \end{pmatrix} \begin{pmatrix} 1 & t_{2s} + L_{34} + t_{1s} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{1s}} & 1 \end{pmatrix} \begin{pmatrix} 1 & L_{12} \\ 0 & 1 \end{pmatrix}$$

for the sagittal plane, where $t_{1s} = \frac{n_1}{n_{2_focus}} L_{23}$, $t_{2s} = \frac{n_1}{n_{2_dichroic}} L_{45}$, L_{23} is

the distance of the optical path inside the focusing lens L_{45} is the distance of the optical path inside the dichroic mirror, L_{12} is the distance from the exit plane of the pumping light source to the focusing lens, L_3 is the distance between the focusing lens and the dichroic concave mirror, L_{56} is the distance between the dichroic mirror and the gain crystal, and L_{67} is the distance between the end of the gain crystal and the arbitrary plane; the ABCD matrix M_{17t} from the exit plane of the pumping light source to the arbitrary plane inside the gain crystal is given by

$$M_{171} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} 1 & L_{36} + \frac{L_{67}}{n_{YAG}} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{21}} & 1 \end{pmatrix} \begin{pmatrix} 1 & t_{21} + L_{34} + t_{11} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{11}} & 1 \end{pmatrix} \begin{pmatrix} 1 & L_{12} \\ 0 & 1 \end{pmatrix} \text{ for}$$

the tangential plane, where $t_{21} = \frac{n_1 \cos^2 \theta_{1_dichroic}}{n_{2_dichroic} \cos^2 \theta_{2_dichroic}} L_{45}$,

$t_{11} = \frac{n_1 \cos^2 \theta_{1_focus}}{n_{2_focus} \cos^2 \theta_{2_focus}} L_{23}$, and, if the gain crystal is cut at the

Brewster angle, then n_{YAG} in M_{171} is changed to n_{YAG}^3 ; and

the q-parameter at the arbitrary plane is given by

$q_7 = \frac{Aq_1 + B}{Cq_1 + D}$ and the arbitrary plane is a focusing point when

Real $(1/q_7) = 0$ is satisfied.

The following is an examiner's statement of reasons for allowance: claim 27 has been allowed over the prior art because they fail to teach a solid-state laser comprising: (a) a laser cavity having a gain crystal and two end mirrors; (b) a pumping light source for supplying pumping light to be led to the gain crystal; (c) a dichroic concave mirror for introducing the pumping light to the gain crystal and constructing the laser cavity or deriving outgoing light; and (d) a lens for focusing the pumping light on the inside of the gain crystal in the laser cavity, wherein the focusing lens is tilted with respect to the optical axis of the pumping light so that the focusing point of the pumping light in a sagittal plane and that in a tangential plane in the gain crystal at least approximately

coincide with the focusing points in the respective planes in the gain crystal in the cavity mode; wherein a focusing point of the pumping light is determined using a q-parameter defined by where $1/q_i = 1/R_i - j(\lambda/\pi w_i^2)$, where w_i is a beam radius at the position i , and R_i is the radius of curvature of a wave front at a position i ; a focal length of the focusing lens having a plano-convex shape is given by $f_{1s} = n_1 R_{\text{focus}} / n_{2_ \text{focus}} \cos \Theta_{2_ \text{focus}} - n_1 \cos \Theta_{1_ \text{focus}}$ for a sagittal plane, where n_1 is a refractive index of air or vacuum, $n_{2_ \text{focus}}$ is a refractive index of the focusing lens, R_{focus} is the radius of curvature of the focusing lens, $\Theta_{1_ \text{focus}}$ is the tilting angle of the focusing lens, and $\Theta_{2_ \text{focus}} = \arcsin [n_1 / n_{2_ \text{focus}} (\sin \Theta_{1_ \text{focus}})]$; a focal length of the focusing lens for a tangential plane is given by $f_{1t} = n_1 R_{\text{focus}} \cos^2 \Theta_{1_ \text{focus}} / n_{2_ \text{focus}} \cos \Theta_{2_ \text{focus}} - n_1 \cos \Theta_{1_ \text{focus}}$; focal length f_{2s} and f_{2t} of the dichroic concave mirror for a transmitting light are given by $f_{2s} = n_1 R_{\text{dichroic}} / n_{2_ \text{dichroic}} \cos \Theta_{2_ \text{dichroic}} - n_1 \cos \Theta_{1_ \text{dichroic}}$; $f_{2t} = n_1 R_{\text{dichroic}} \cos^2 \Theta_{1_ \text{dichroic}} / n_{2_ \text{dichroic}} \cos \Theta_{2_ \text{dichroic}} - n_1 \cos \Theta_{1_ \text{dichroic}}$; an ABCD matrix from an exit plane of the pumping light source to an arbitrary plane inside the gain crystal is given by

$$\text{by } M_{17s} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} 1 & L_{36} + \frac{L_{67}}{n_{\text{LAG}}} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{1s}} & 1 \end{pmatrix} \begin{pmatrix} 1 & t_{2s} + L_{34} + f_{1s} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{1s}} & 1 \end{pmatrix} \begin{pmatrix} 1 & L_{12} \\ 0 & 1 \end{pmatrix}$$

Art Unit: 2828

$$t_{1r} = \frac{n_1}{n_{2_focus}} L_{23}, \quad t_{2s} = \frac{n_1}{n_{2_dichroic}} L_{45}, \quad L_{23}$$

for the sagittal plane, where

is the

distance of the optical path inside the focusing lens L_{45} is the distance of the optical path inside the dichroic mirror, L_{12} is the distance from the exit plane of the pumping light source to the focusing lens, L_3 is the distance between the focusing lens and the dichroic concave mirror, L_{56} is the distance between the dichroic mirror and the gain crystal, and L_{67} is the distance between the end of the gain crystal and the arbitrary plane;

the ABCD matrix M_{17t} from the exit plane of the pumping light source to the arbitrary plane inside the gain crystal is given by

$$M_{17t} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} 1 & L_{56} + \frac{L_{67}}{n_{YAG}} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{2t}} & 1 \end{pmatrix} \begin{pmatrix} 1 & t_{2s} + L_{34} + t_{1r} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\frac{1}{f_{1r}} & 1 \end{pmatrix} \begin{pmatrix} 1 & L_{12} \\ 0 & 1 \end{pmatrix}$$

for the tangential plane,

$$\text{where } t_{2t} = \frac{n_1 \cos^2 \theta_{1_dichroic}}{n_{2_dichroic} \cos^2 \theta_{2_dichroic}} L_{45}, \quad t_{1t} = \frac{n_1 \cos^2 \theta_{1_focus}}{n_{2_focus} \cos^2 \theta_{2_focus}} L_{23}, \quad \text{and in}$$

addition, if the gain crystal is cut at the Brewster angle,

then n_{YAG} in M_{17s} is changed to n_{YAG}^3 ; and

$$q_7 = \frac{Aq_1 + B}{Cq_1 + D}$$

the q-parameter at the arbitrary plane is given by

and the

arbitrary plane is a focusing point when $\text{Real}(1/q_7) = 0$ is satisfied.

Claims 28 - 41 has been found allowable due to their dependency on claims 26 and 27.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reason for Allowance".

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Delma R. Flores Ruiz whose telephone number is (571) 272-1940. The examiner can normally be reached on M - F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Don Wong can be reached on (571) -272-1834. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2828

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Delma R. Flores Ruiz

Examiner
Art Unit 2828

DRFR/DW
April 29, 2004

Don Wong
Supervisor Patent Examiner
Art Unit 2828



Wilson Lee
Primary Examiner